



Modified degenerate fingerprinting for detecting incipient climate bifurcations

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We propose degenerate fingerprinting method that assesses the proximity of a system to a bifurcation point. We estimate the declining decay rate of fluctuations in a time series as an indicator of approaching a critical state. The method employs Detrended Fluctuation Analysis (DFA) which improves the estimation of short-term decay. When the method is applied to GENIE-1 model output that simulates collapse of the Atlantic thermohaline circulation, the bifurcation point is correctly anticipated. In the Greenland ice core paleotemperature data, the technique properly detects the transition from glacial to interglacial conditions. In the observed daily temperature record in Southern France, the critical behaviour during the heat wave of 2003 is correctly detected. The technique could in principle be used to anticipate bifurcations in the climate system, provided high-resolution time series of the relevant data are available.

[1] V.Livina and T.M.Lenton, A modified method for detecting incipient bifurcations in a dynamical system, *Geophys. Res. Lett.* 34, L03712 (2007).